

# RUPTURE OF A CESAREAN-SCARRED UTERUS: A COMMUNITY HOSPITAL EXPERIENCE

Pedro A. Poma, MD

Chicago, Illinois

---

Concerns that a scarred uterus may rupture during labor have contributed to increased cesarean rates. A previous cesarean has become one of the most common indications for abdominal birth. More women must deliver vaginally after cesarean if we are to reduce cesarean rates. This study evaluates the effect of decreasing cesarean rates and increased vaginal birth after cesarean (VBAC) rates on the incidence of uterine rupture in a community hospital.

We studied data for women who delivered at our obstetrical unit from 1988 through 1997. During 1994 our department adopted strategies to reduce cesarean rates. Data from women who delivered from 1988 through 1993 (period A, before the policy change) were compared with data for those who delivered from 1994 through 1997 (period B, after the policy change) and evaluated by chi-square analysis.  $p < 0.05$  was considered significant.

The total cesarean rate decreased from 24.3% (period A) to 17.9% (period B) ( $p < 0.0001$ ), whereas the primary cesarean rate decreased from 14.9% to 10.3% ( $p < 0.0001$ ), and the repeat rate decreased from 9.4% to 7.6% ( $p < 0.0001$ ). The VBAC rate increased from 13.0 to 28.6 ( $p < 0.0001$ ), whereas the incidence of uterine rupture did not change. During the study period, the cesarean rate decreased while the VBAC rate safely increased. The incidence of uterine rupture remained unchanged. (*J Natl Med Assoc.* 2000;92:295-300.)

---

**Key words:** uterine rupture ♦  
vaginal birth after cesarean ♦  
reducing cesarean rates

Uterine rupture represents a catastrophic event for everyone involved. Although its frequency has not changed in decades (0.07% of all births),<sup>1-3</sup> etiologic factors and the clinical presentation of uterine rupture have changed.<sup>1-3</sup> In the past, rup-

ture usually occurred in women with an intact uterus,<sup>1,2</sup> whereas it now occurs in women with a scarred uterus (usually a scar from a previous cesarean birth).<sup>1-4</sup> In addition, its clinical presentation has become less dramatic than it was in the past.<sup>1,2,5</sup> An obstetrician may discover a uterine rupture, when doing an elective repeat cesarean<sup>4-6</sup> or a laparotomy for other indications,<sup>6</sup> or a rupture may only be noted postpartum.<sup>4</sup> Mortality and morbidity rates associated with uterine ruptures have improved<sup>1-6</sup>; uterine rupture identified early often carries minimal maternal and perinatal mortality and morbidity.<sup>1-6</sup> Still, fear of uterine rupture prevents some practitioners and many women from attempting a trial of labor and vaginal birth after cesarean

---

© 2000. From the University of Illinois at Chicago and the Department of Obstetrics and Gynecology, Ravenswood Hospital Medical Center, Chicago, Illinois. Requests for reprints should be addressed to Department of Obstetrics and Gynecology, Ravenswood Hospital Medical Center, 4550 N. Winchester Avenue, Chicago, IL 60640-5205.

(VBAC).<sup>7</sup> They fear that increasing VBAC rates may result in an increased incidence of uterine rupture.<sup>3,7</sup>

In 1994, after review of the pertinent literature, members of our department concluded that our cesarean rate was too high. The department adopted labor management and cesarean guidelines<sup>8,9</sup> and a goal of less than 15% annual cesarean rate.<sup>10</sup> The members recommended reviewing cases that did not meet established criteria, with individual feedback, and dissemination of case reviews, supporting literature, departmental rates, and coded individual rates. The department also established a 24-h in-house service (e.g., an obstetrician on the premises, ready to manage any patient admitted to the unit).<sup>11</sup>

Dystocia, nonreassuring fetal status, and previous cesarean births are common indications for cesarean births. During 1994, the members of the department agreed that before a cesarean for dystocia was done, the woman had to be in active labor (e.g., with regular contractions of adequate intensity [ $>50$  mm Hg] every 2 to 3 min and with cervical dilation  $\geq 3$  cm) and show no change of cervical dilation for 2 h or change of descent in the second stage of labor. The attending physician must document occurrence of amniotomy and oxytocin use and a pelvic examination must be performed before a cesarean procedure is carried out. In the presence of nonreassuring fetal patterns after correcting for maternal position, excessive uterine stimulation, and maternal hypotension, the attending physician must stimulate the fetal scalp or use an artificial larynx. When fetal stimulation does not cause acceleration, a low scalp pH must be documented before proceeding with a cesarean birth. And, women who had a previous cesarean birth with no contraindications for vaginal delivery are counseled to attempt a vaginal birth. Because members followed these guidelines, cesarean birth rates decreased.

The purpose of this study is to evaluate the effects of the cesarean rate decrease and VBAC increase on the incidence of uterine rupture.

## MATERIALS AND METHODS

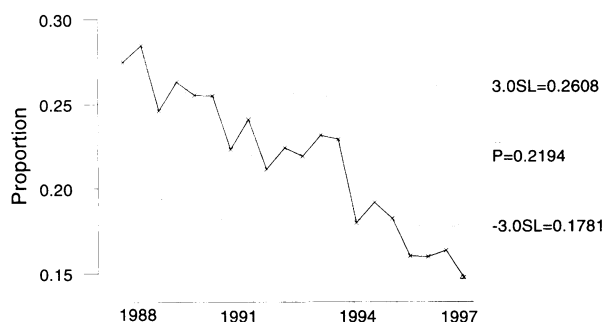
Ravenswood Hospital Medical Center is a 480-bed acute-care hospital located on Chicago's north side. From January 1, 1988, to December 31, 1997, 21,012 women delivered in our unit. A review of these records was conducted. Demographic and

clinical characteristics, cesarean delivery indications and other obstetrical procedures, maternal and perinatal mortality and morbidity, birth trauma, low Apgar scores, and admissions of newborns (2500 g or more) to the special care nursery were analyzed.

Total cesarean rate includes both primary and repeat rates. Total cesarean rate is the proportion of cesarean deliveries from the total number of deliveries (e.g., number of cesarean deliveries  $\times 100$ /total number of deliveries). A repeat cesarean is one performed on a woman who has previously undergone a cesarean delivery. Repeat cesarean rate is the proportion of repeat cesareans from the total number of deliveries. The rate of vaginal births after cesarean delivery (VBAC rate) is the number of vaginal births after cesarean  $\times 100$ , divided by the number of women who had undergone previous cesarean deliveries.

The term *uterine dehiscence* refers to the myometrial gap in a previous uterine scar, covered by intact fetal membranes, with minimal or no bleeding. Dehiscence does not require any further treatment, because it does not affect prognosis.<sup>4,5,12,13</sup> The true incidence of uterine dehiscence is unknown, because practitioners rarely explore the uterus after VBAC.<sup>4,5</sup> This study does not include cases of uterine dehiscence. *Uterine rupture* represents a communication of the uterus with the peritoneal cavity. In these cases, the membranes are ruptured, and the fetus is either still contained within the uterus, or partially or completely extruded into the peritoneal cavity.<sup>4,5,12</sup> Rupture commonly occurs in the previous scar (in reality, a separation of the scar), but it can occur in other areas of the uterus and may affect vascular supply, bladder, and vagina.<sup>5,12,13</sup> Uterine rupture can occur before or during labor. It may be discovered when cesarean or laparotomy are done for an indication other than suspected uterine rupture, or may even be noted after delivery.<sup>4-6,12,13</sup> Rupture requires laparotomy to control bleeding and restore the anatomy.

We report cesarean and VBAC rates and other obstetrical procedures and summarize maternal and newborn characteristics. The data have been grouped by semesters and presented in proportion of defectives-control charts (p charts) using Minitab for Windows (version 11.21, 1996, State College, PA). SPSS for Windows 6.1 software (Microsoft Co., Redmond, WA) was used for statistical analysis. Pearson  $\chi^2$  analysis was used to evaluate the differences between the proportions. Comparisons were



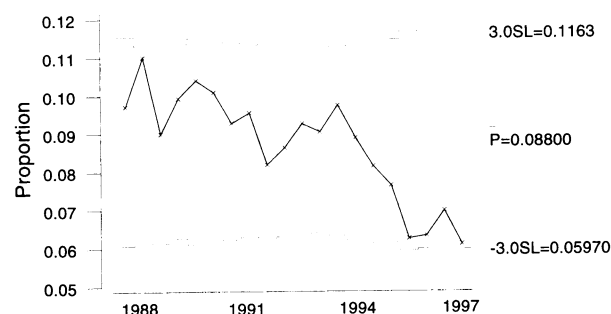
**Figure 1.** Total cesarean birth rates by semesters, 1988 through 1997 (p-chart). Total deliveries were 21,012, and total cesarean deliveries were 4611; the resulting rate was 21.9%. The range represents  $\pm 3$  sigma ( $\sigma$ ) deviations.

made of data from 1988 and 1997, as well as between the first 6-year period (period A, before the change in policy) and the second 4-year period (period B, after the change in policy). A  $p$  value of  $<0.05$  was considered significant.

## RESULTS

From January 1, 1988, through December 31, 1997, 21,012 women delivered in our unit, 4611 (21.9%) of them by cesarean. The women during this study period shared similar demographic characteristics and other clinical outcomes. Cesarean rates decreased during the study period. The total cesarean rate decreased from 28.0% (597/2131) in 1988 to 15.5% (276/1777) in 1997 ( $p < 0.0001$ ) (Fig. 1). The primary rate decreased from 17.6% (375/2131) to 9.0% (160/1777), and the repeat rate decreased from 10.4% (222/2131) to 6.5% (116/1777) ( $p < 0.0001$ ) (Fig. 2). While cesarean rates decreased from period A to period B, oxytocin use and operative vaginal deliveries increased (from 3.4% [454/13185] to 5.5% [428/7827],  $p < 0.0001$ ) (Table 1). The VBAC rate increased during the study period (Fig. 3), from 4.3 (10/232) in 1988 to 37.6 (70/186) in 1997 ( $p < 0.0001$ ) (Fig. 4). Similarly, the VBAC rate increased from 13.0 (188/1440) in period A to 28.6 (239/836) in period B ( $p < 0.0001$ ).

Ten women had uterine rupture during this period (0.05%, 10/21,012), representing 1.6% of attempted vaginal births after cesarean (10/616 of attempted VBACs). Six ruptures occurred during the period A (0.04%, 6/13,185) and four during the period B (0.05%, 4/7827) ( $p = 0.857$ ). The proportion of uterine rupture from the number of women



**Figure 2.** Repeat cesarean birth rates by semesters, 1988 through 1997 (p-chart). Total deliveries were 21,012, and the total repeat cesarean deliveries were 1849; the resulting rate was 8.8%. The range represents  $\pm 3$  sigma ( $\sigma$ ) deviations.

with a previous cesarean and the proportion from the number of VBACs are similar. Ruptures occurred in 0.4% of women with previous cesarean (total, 10/2276; period A, 0.4%, 6/1440 vs. period B, 0.5%, 4/836 [ $p = 0.830$ ]) and in 2.3% of women who had VBACs (total, 10/427; period A, 3.2%, 6/188 vs. period B, 1.7%, 4/239 [ $p = 0.303$ ]) (Fig. 5). The age of these women ranged from 22 to 35 years (mean 28.8, SD 4.6). Five women had only one previous cesarean, two had two, and three had three. The gestational age ranged from 36 to 40 weeks (mean 38, SD 1.2). Most of the fetuses (nine of ten) were in vertex presentation. Half of the women were admitted after rupture of membranes.

Half of the cases of rupture were noted during an elective repeat cesarean procedure, three during period A and two during period B. If we were to exclude these cases, our incidence of uterine rupture would be halved; however, the proportion of ruptures would remain the same between periods A and B. The other five women were admitted in labor (one of them in premature labor). Three of them developed nonreassuring fetal heart rate patterns during labor; at the time of cesarean delivery, one patient's fetus was found in the uterus, one patient had partial fetal extrusion, and the third had complete fetal extrusion. The other two women had cesareans for secondary arrest of labor during attempted VBAC; neither of these fetuses was extruded. Most of the ruptures (nine of ten) were associated with low transverse uterine scars. Nine women had the scar repaired, and the other had a hysterectomy. Half of the newborns were male and half female, with weights ranging from 2790 to 4110 g (mean 3559.5, SD 403.7). The mean Apgar

Table 1. Obstetrical Variables\*

Variable	Period A (1988-1993) (Total Deliveries, 13,185)		Period B (1994-1997) (Total Deliveries, 7827)		Total (Total Deliveries, 21,012)	
	N	Rates	N	Rates	N	Rates
Total cesareans	3211	24.3	1400	17.9	4611	21.9
Primary	1959	14.9	803	10.3	2762	13.1
Repeat	1252	9.4	597	7.6	1849	8.8
Oxytocin use						
Induction	652	4.9	928	11.9	1580	7.5
Augmentation	3656	27.7	3194	40.8	6850	32.6
Vaginal interventions						
Forceps	286	2.2	115	1.5	401	1.9
Vacuum	168	1.3	313	4.0	481	2.3

\*Period A vs. period B,  $p < 0.0001$ .

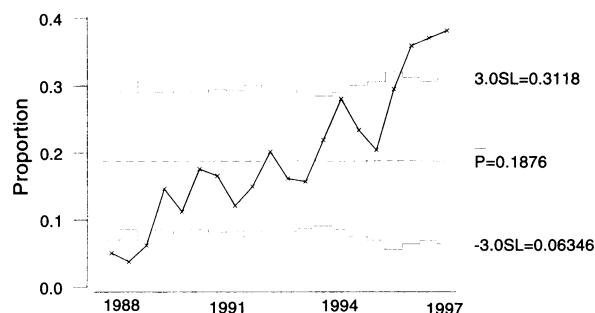
scores were 6.8, 8.4, and 9.5 at 1, 5, and 10 min, respectively. In all cases, both maternal and neonatal outcomes were good.

## DISCUSSION

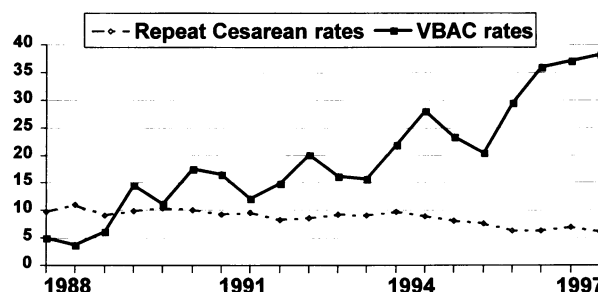
Despite a significant decrease in cesarean rates and an increase in VBAC rates, the incidence of uterine rupture in our community hospital remained at 0.05% during the study period. Rupture of a cesarean-scarred uterus rarely occurs,<sup>1-6</sup> and when it does, it is usually associated with a good prognosis.<sup>1-6</sup> In 1997, 53.8% (100/186) of women who delivered in our unit with a previous cesarean birth attempted vaginal delivery, compared to 40.5% nationwide.<sup>14</sup> Our 1997 VBAC rate of 37.6 compares favorably to the 28.3 national rate.<sup>14</sup> Still,

some practitioners fear that the incidence of uterine rupture might markedly increase if all women eligible for VBAC were to attempt a trial of labor. Obstetricians and the public must realize that a trial of labor is not the best choice for every woman with a previous cesarean birth.

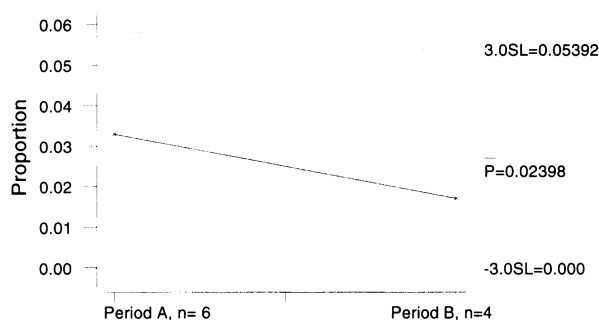
Rupture of a cesarean-scarred uterus may be associated with maternal and perinatal mortality and severe morbidity.<sup>5</sup> Although ruptures rarely occur, practitioners must be constantly aware of this possibility. Most obstetrical units are equipped to manage uterine ruptures properly and are ready to act to prevent severe complications. Some complications commonly requiring immediate abdominal delivery are total placenta previa (0.5%), severe abruption placentae (0.6%), cord presentation (0.2%), velamentous insertion of the cord (0.5%), and breech presentation in labor (<3%).<sup>14</sup> Cumulatively, these complications represent more cases than those associated with rupture of a cesarean-



**Figure 3.** Vaginal birth after cesarean rates by semesters, 1988 through 1997 (p-chart). The number of women with previous cesarean births was 2276, and the number of vaginal births after cesarean was 427; the resulting VBAC rate was 18.8%. The range represents  $\pm 3$  sigma ( $\sigma$ ) deviations.



**Figure 4.** Comparison of repeat cesarean and VBAC rates, 1988 through 1997. Repeat cesarean rates decreased, whereas VBAC rates increased.



**Figure 5.** Uterine rupture during the two periods (p-chart). Period A, 3.2% (6/188). Period B, 1.7% (4/239). The range represents  $\pm 3$  sigma ( $\sigma$ ) deviations.

scarred uterus ( $<1\%$ ).<sup>1-7,12</sup> Moreover, rupture of a cesarean-scarred uterus can occur before term, even before labor begins,<sup>1-7,12,13</sup> and women may arrive in the unit with ruptured uteri. This illustrates why it is impossible to predict some cases of uterine rupture. However, early detection decreases maternal and fetal/neonatal morbidity and mortality.<sup>1-7,12</sup>

The risk factors of uterine rupture have changed. Uterine rupture was once associated with grand multiparity, injudicious use of oxytocin, intrauterine manipulation, forceps deliveries, and abandoned labors.<sup>1-3</sup> The clinical presentation included severe pain, vaginal bleeding, cessation of contractions, absence of fetal heart rate, palpable fetal parts, elevation of the presenting part, and maternal shock.<sup>1-4</sup> Common outcomes included maternal mortality (4.2%)<sup>1</sup>; perinatal mortality (45.8%)<sup>1</sup>; or a compromised newborn, maternal hypovolemic shock, excessive blood transfusions, hysterectomy, hypogastric artery ligation, and postoperative sepsis.<sup>1-4</sup> More recently, the incidence of rupture of an intact uterus has decreased (0.008%),<sup>2,5</sup> whereas the proportion of rupture of the cesarean-scarred uterus has increased.<sup>1-7,12</sup> The rupture of a cesarean-scarred uterus has become the most common reason for uterine rupture today.<sup>1-7,12</sup>

VBAC counseling should begin during the postoperative period of a lower uterine segment transverse cesarean. Most women who have a cesarean-scarred uterus, have no recurrent indications, and agree to a trial of labor will safely deliver their next infant vaginally.<sup>2-5,12-15</sup> Obstetrical units must be ready to respond to emergencies in a timely fashion, however. Although VBACs are associated with a low rate of uterine rupture ( $<1\%$ ), the following characteristics are associated with an increased risk when

compared with women with one low-transverse scar: a) type of incision: the low-vertical incision, usually done before adequate formation of the lower uterine segment, may include the active portion of the uterus (the corpus) and may be associated with a 5%–10% incidence of uterine rupture, as is the classical incision<sup>12,15</sup>; b) number of previous cesareans: the incidence of rupture after one cesarean is 0.6%, after two is 2.3%, and is 2.8% for women with more than two cesareans<sup>12,15</sup> (these women must be informed of their increased risk); and c) management of labor: diluted oxytocin drip for augmentation and lumbar epidural analgesia can still be used. However, evidence of labor abnormalities should be considered a warning sign, as oxytocin use and labor abnormalities have been associated with increased odds for uterine rupture (2.4 and 8.1).<sup>5,12,15</sup> Intrauterine pressure catheters do not provide early evidence of uterine rupture.<sup>6,16</sup> Recently, a case-control study found that women who suffer a uterine rupture had fewer uterine contractions per hour than controls, whereas the incidence of hypertonus and tachysystole was similar between cases and controls.<sup>17</sup> Thus, uterine rupture is not necessarily associated with excessive uterine activity.

Nonreassuring electronic fetal monitoring tracings have been associated with uterine rupture.<sup>2-5,7,12,15</sup> The presence of prolonged decelerations (fetal heart rate of 90 for longer than 1 min)<sup>4,15</sup> in a laboring woman with a previous cesarean birth requires delivery within 17 min to avoid significant neonatal morbidity.<sup>15</sup> When prolonged decelerations have been preceded by late decelerations (within 36 to 90 min),<sup>15</sup> this interval decreases to 10 min.<sup>15</sup> Variable decelerations also have a similar prognosis.<sup>2,4,7,12,15</sup> The brief window of opportunity associated with good outcomes requires readiness of the obstetrical surgical team. This team includes an obstetrician, surgical assistants, anesthesiologist, surgical suite nurses, pediatrician and nursery nurses, and laboratory staff. The prenatal records of patients who will attempt VBAC should arrive at the obstetrical unit by 36 weeks of gestation. The availability of blood should be considered for these patients. The few women who arrive with a possible uterine rupture should be admitted directly to the obstetrical operating room where evaluation and treatment should be performed without delay. The obstetrical team must be prepared to act immediately when uterine rupture has been identified.

## CONCLUSION

Practitioners must carefully consider each cesarean, because the first cesarean places the woman and fetus at risk for future complications.<sup>18-20</sup> Our department members' participation in the development of and their adherence to evidence-based policies for cesarean birth have influenced the decrease in the total cesarean rate at our institution. Elective repeat cesareans at term will not always prevent uterine rupture,<sup>4-6,12,13</sup> because a proportion (50% in this study) occurs before labor. This study confirms that increased VBAC use helps reduce cesarean rates without increasing the rate of uterine rupture.<sup>21</sup> The ideal candidate for a trial of vaginal delivery is the informed woman with one low transverse cesarean birth and no recurrent indication.<sup>21</sup> Once a woman begins her attempt at vaginal delivery, practitioners must closely observe the progress of labor and the fetal heart rate and respond quickly to deviations from normal to improve outcomes.

## REFERENCES

- Eden RD, Parker RT, Gall SA. Rupture of the pregnant uterus: a 53-year review. *Obstet Gynecol.* 1986;68:671-674.
- Miller DA, Goodwin TM, Gherman RB, Paul RH. Intrapartum rupture of the unscarred uterus. *Obstet Gynecol.* 1997;89:671-673.
- Miller DA, Diaz FG, Paul RH. Vaginal birth after cesarean: a 10-year experience. *Obstet Gynecol.* 1994;84:255-258.
- Lynch JC, Pardy JP. Uterine rupture and scar dehiscence: a five-year survey. *Anaesth Intensive Care.* 1996;24:699-704.
- Farmer RM, Kirschbaum T, Potter D, Strong TH, Medearis AL. Uterine rupture during trial of labor after previous cesarean section. *Am J Obstet Gynecol.* 1991;165:996-1001.
- Klein M, Rosen A, Beck A. Diagnostic potential of cardiotocography for silent uterine rupture. *Acta Obstet Gynecol Scand.* 1989;68:653-656.
- Cowan RK, Kinch RAH, Ellis B, Anderson R. Trial of labor following cesarean delivery. *Obstet Gynecol.* 1994;83:933-936.
- Department of Health, and Human Services. *Cesarean Childbirth: Report of the Consensus Development Conference.* Bethesda, MD: National Center for Health Care Technology; Sept. 22-24, 1980.
- American College of Obstetricians, and Gynecologists Committee on Quality Assurance. *Quality Assessment in Obstetrics and Gynecology.* Washington, DC, ACOG, 1994:85-86.
- U.S. Department of Health and Human Services. *Healthy People 2000: National Health, Promotion and Disease Prevention Objectives.* Washington, DC: US Department of Health and Human Services; 1990.
- Poma PA. Effect of departmental policies on cesarean delivery rates. A community hospital experience. *Obstet Gynecol.* 1998;91:1013-1018.
- Leung AS, Leung EK, Paul RH. Uterine rupture after previous cesarean delivery: maternal and fetal consequences. *Am J Obstet Gynecol.* 1993;169:945-950.
- Phelan JP, Clark SL, Diaz F, Paul RH. Vaginal birth after cesarean. *Am J Obstet Gynecol.* 1987;157:1510-1515.
- Ventura SJ, Martin JA, Curtin SC, Mathews TJ. *Report of Final Natality Statistics, 1996. Monthly Vital Statistics Report; Vol. 46 No. 11, Suppl.* Hyattsville, MD: National Center for Health Statistics; 1998.
- Leung AS, Farmer RM, Leung EK, Medearis AL, Paul RH. Risk factors associated with uterine rupture during trial of labor after cesarean delivery: a case-control study. *Am J Obstet Gynecol.* 1993;168:1358-1363.
- Rodriguez MH, Masaki DI, Phellan JP, Diaz FG. Uterine rupture: are intrauterine pressure catheters useful in the diagnosis? *Am J Obstet Gynecol.* 1989;161:666-669.
- Phelan JP, Korst LM, Settles DK. Uterine activity patterns in uterine rupture: a case control study. *Obstet Gynecol.* 1998;92:394-397.
- Chazotte C, Cohen WR. Catastrophic complications of previous cesarean section. *Am J Obstet Gynecol.* 1990;163:738-742.
- Morrison JJ, Rennie JM, Milton PJ. Neonatal respiratory morbidity and mode of delivery at term: Influence of timing of elective cesarean section. *Br J Obstet Gynaecol.* 1995;102:101-106.
- Hemminki JL, Meriläinen J. Long-term effects of cesarean section: ectopic pregnancy and placental problems. *Am J Obstet Gynecol.* 1996;174:1569-1574.
- American College of Obstetricians and Gynecologists. *Practice Bulletin No. 2. Vaginal Birth after Previous Cesarean Delivery.* ACOG: Washington, DC; October 1998.